F I G. 1 PRIOR ART

200 SCANNER

204
BINARY PROCESSOR UNIT

MULTIVALUE PIXEL SIGNAL

BINARY PIXEL SIGNAL

202 PRINTER

206
IMAGE-QUALITY CORRECTOR UNIT

BINARY PRINT SIGNAL

PRIOR ART
F I G. 2 A

PRIOR ART
F I G. 2 B

PRIOR ART
F I G. 3 A

PRIOR ART
F I G. 3 B

PRIOR ART
F I G. 3 C

FIG. 4A PRIOR ART

BASIC DOT SIZE
(PRIMARY SCAN DIRECTION)

BASIC DOT SIZE
(SECONDARY)

FIG. 4B PRIOR ART

BASIC DOT SIZE
(PRIMARY SCAN DIRECTION)

PRIOR ART
F I G. 5 A

PRIOR ART
F I G. 5 B

FIG. 6

COMPOSITE-IMAGE
PRINTING APPARATUS
10

SCANNER
14

OPERATION
DISPLAY
PANEL UNIT
16

PRINTER
12

PAPER
TRAY
18

20
STACKER

FIG. 7

F I G. 8

FIG. 9

10

OPERATION DISPLAY PANEL UNIT 16

14 SCANNER

SCANNER ENGINE 22

SCANNER CONTROLLER UNIT 24

ERROR-VARIANCE BINARY UNIT 26

SCANNER IF UNIT 32

PRINTER ENGINE 30

LD UNIT 40

SPINDLE MOTOR 42

PRINTER CONTROLLER UNIT 28

IMAGE-QUALITY CONTROLLER UNIT 34

OPTICAL CONTROLLER UNIT 36

PRINTER-ENGINE CONTROLLER UNIT 38

12 PRINTER

COMMUNICATION CONTROLLER UNIT 15

TO SERVER

FIG.10A

50 DATA LINE MEMORY

	$n-2^{TH}$ DOT	$n-1^{TH}$ DOT	n^{TH} DOT	$n+1^{TH}$ DOT	$n+2^{TH}$ DOT
m^{TH} LINE			$D_{m,n}$	$D_{m,n+1}$	$D_{m,n+2}$
$m+1^{TH}$ LINE	$D_{m+1,n-2}$	$D_{m+1,n-1}$	$D_{m+1,n}$	$D_{m+1,n+1}$	$D_{m+1,n+2}$
$m+2^{TH}$ LINE	$D_{m+2,n-2}$	$D_{m+2,n-1}$	$D_{m+2,n}$	$D_{m+2,n+1}$	$D_{m+2,n+2}$

$D_{m,n}$

58

$D_{m,n+1}$
$D_{m,n+2}$
$D_{m+1,n-2}$
$D_{m+1,n-1}$
$D_{m+1,n}$
$D_{m+1,n+1}$
$D_{m+1,n+2}$
$D_{m+2,n-2}$
$D_{m+2,n-1}$
$D_{m+2,n}$
$D_{m+2,n+1}$
$D_{m+2,n+2}$

$D_{m,n+1}$
$D_{m,n+2}$
$D_{m+1,n-2}$
$D_{m+1,n-1}$
$D_{m+1,n}$
$D_{m+1,n+1}$
$D_{m+1,n+2}$
$D_{m+2,n-2}$
$D_{m+2,n-1}$
$D_{m+2,n}$
$D_{m+2,n+1}$
$D_{m+2,n+2}$

FIG.10B

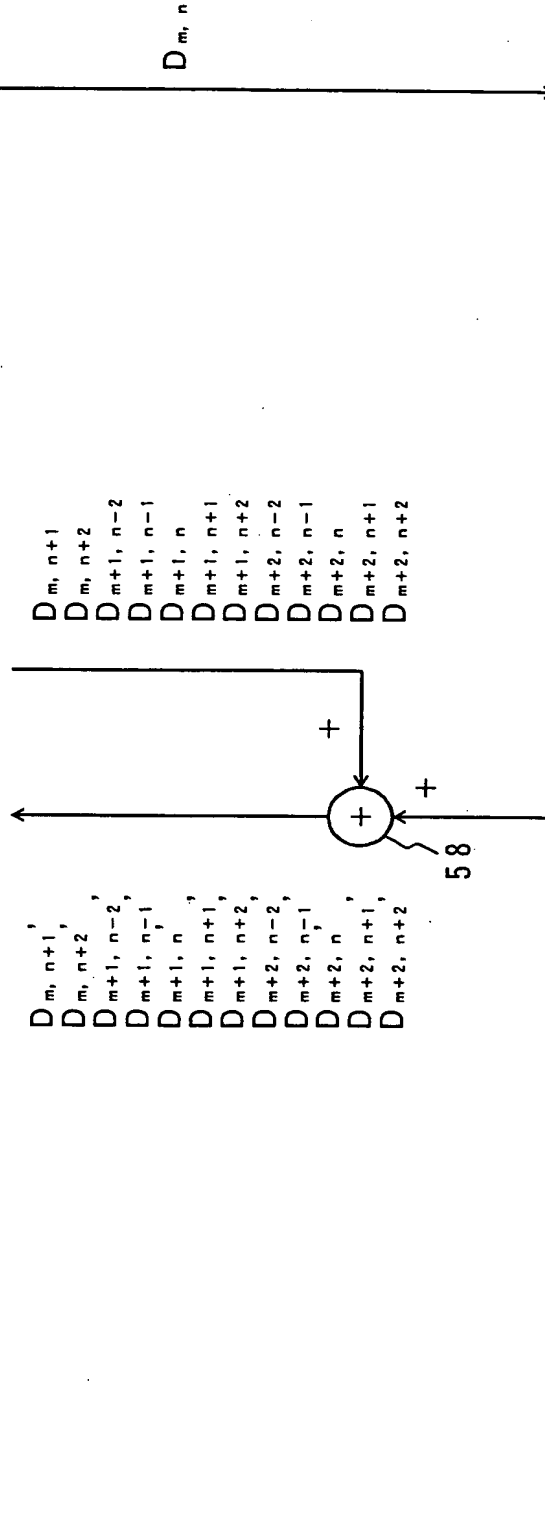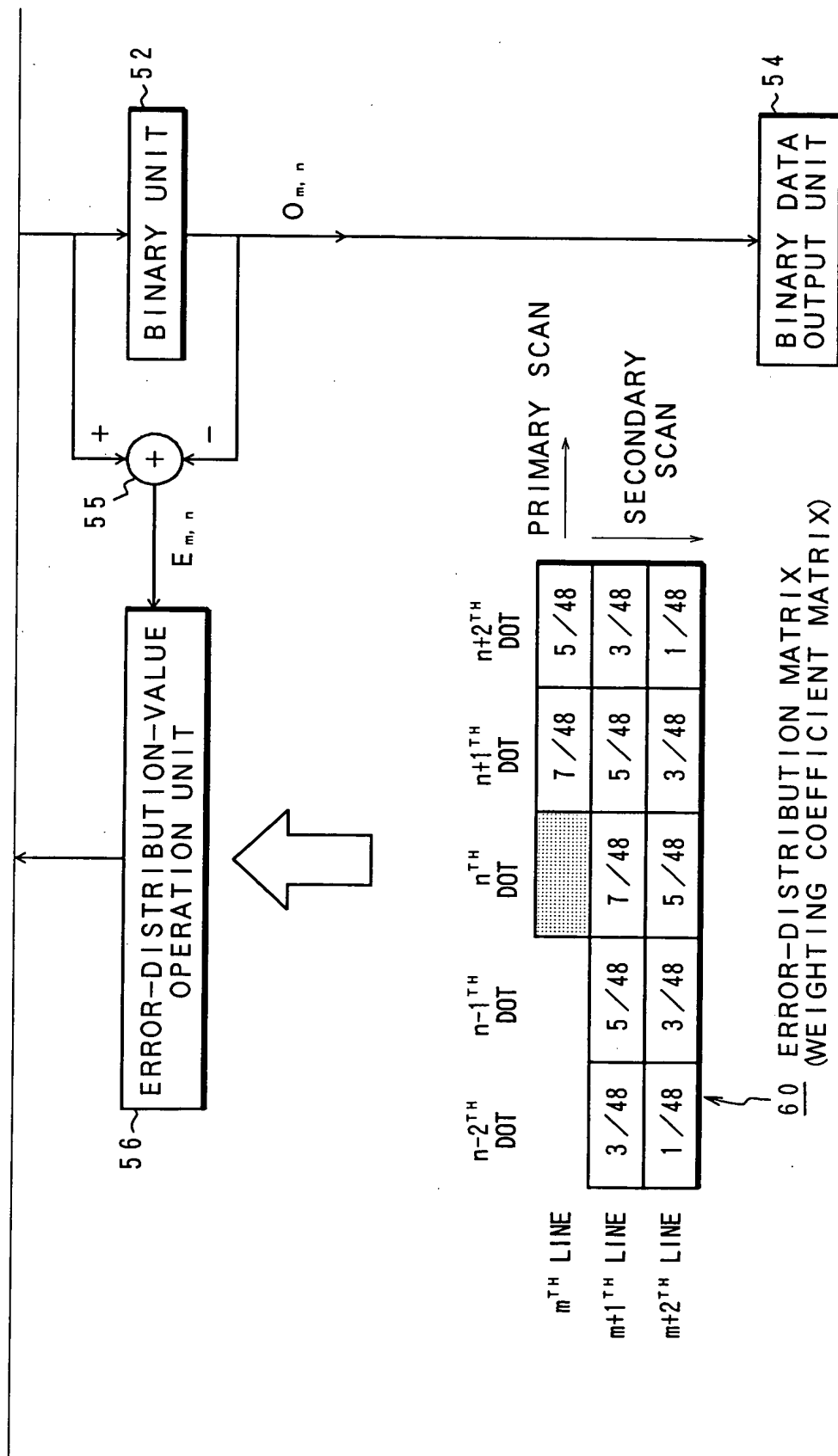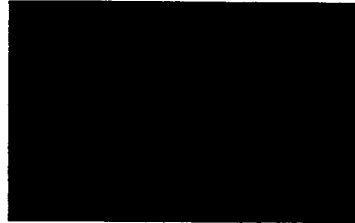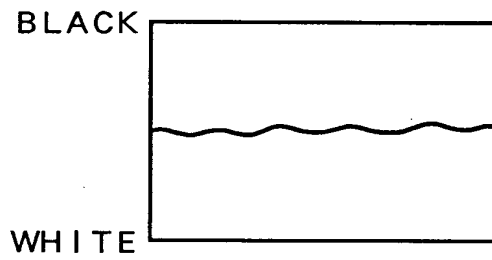ERROR-DISTRIBUTION-VALUE OPERATION UNIT ~ 56

BINARY UNIT ~ 52

$O_{m, n}$

BINARY DATA OUTPUT UNIT ~ 54

$E_{m, n}$

55

+ −

PRIMARY SCAN →

SECONDARY SCAN

	n−2TH DOT	n−1TH DOT	nTH DOT	n+1TH DOT	n+2TH DOT
mTH LINE				7/48	5/48
m+1TH LINE	3/48	5/48	7/48	5/48	3/48
m+2TH LINE	1/48	3/48	5/48	3/48	1/48

ERROR-DISTRIBUTION MATRIX (WEIGHTING COEFFICIENT MATRIX) 60

FIG. 11A

FIG. 11B

BLACK

WHITE

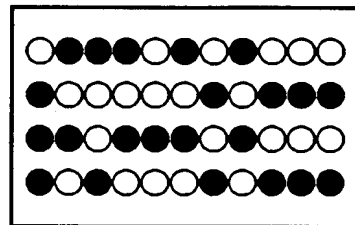FIG. 11C

F I G. 1 2 A

ORIGINAL PICTURE
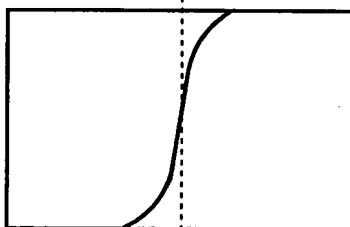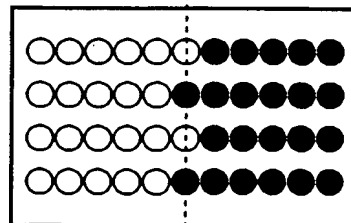IMAGE

F I G. 1 2 B

MULTIVALUE DENSITY
LEVEL

BLACK

WHITE

F I G. 1 2 C

OUTPUT IMAGE

F I G. 1 3 A

BLACK

F I G. 1 3 B

WHITE

F I G. 1 3 C

FIG.14

FIG.15

FIG.16

INPUT DOT DATA
74

b10	b09	b08	b07	b06	b05	b04	b03	b02	b01	b00

66

70

PRIMARY-SCAN-DIRECTION ADDRESS SPECIFICATION UNIT

	1	2	3	4	5	6	7	8	9	10	11
A											
B											
C											
D											
E											
F						□					
G											
H											
I											
J											
K											

71

SECONDARY-SCAN-DIRECTION ADDRESS SPECIFICATION UNIT

72 ATTENTION DOT

FIG.17A

FIG.17B

THIRD IMAGE-QUALITY CORRECTOR UNIT 84

THIRD CORRECTOR UNIT 104

THIRD COMPARATOR UNIT (ISOLATED-DOT DETECTION) 100

102

ISOLATED-DOT-PATTERN STORAGE UNIT

CONTROLLER UNIT 75

FIG.18A

START

S1 → INPUT BINARY IMAGE DATA

S2 → CUT OFF JUDGMENT MATRIX

S3 → PERFORM COMPARISON TO FIRST IRREGULARITY DETECTION PATTERN

S4 → PATTERNS MATCHED?
- YES
- NO

S5 → INTERRUPTION FLAG TURNED ON?
- YES
- NO

S6 → PERFORM COMPARISON TO SECOND IRREGULARITY DETECTION PATTERN

S7 → PATTERNS MATCHED ?
- YES
- NO

S12 → TURN ON INTERRUPTION FLAG FOR SMOOTHING PROCESSING WITH SECOND IRREGULARITY DETECTION PATTERN

F I G. 1 8 B

S8 CORRECT ATTENTION DOT AND PERFORM SMOOTHING PROCESSING FOR IRREGULARITY

S9 PERFORM COMPARISON TO ISOLATED-DOT DETECTION PATTERN

S10 PATTERNS MATCHED ? — NO / YES

S11 PERFORM VARIANCE-CORRECTION OF ISOLATED DOT

S13 CORRECT ATTENTION DOT AND PERFORM SMOOTHING PROCESSING FOR IRREGULARITY

S14 OUTPUT PROCESSING DOT

S15 ALL DOTS PROCESSED ? — NO / YES

END

FIG.19

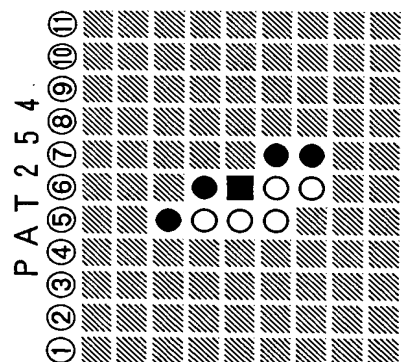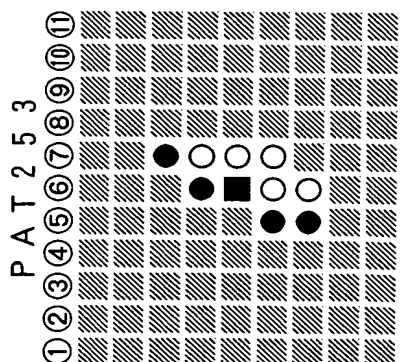| STORAGE UNITS	PATTERN CONTENTS	BINARY METHODS
FIRST IRREGULAR-PATTERN STORAGE UNIT	SLANTING-LINE IRREGULARITY DETECTION PATTERN	SIMPLE BINARY/DITHER
SECOND IRREGULAR-PATTERN STORAGE UNIT	VERTICAL/HORIZONTAL-LINE IRREGULARITY DETECTION PATTERN	ERROR VARIANCE
	THIN-LINE PATCHY DETECTION PATTERN	ERROR VARIANCE
ISOLATED-DOT-PATTERN STORAGE UNIT	ISOLATED-DOT DETECTION PATTERN	ERROR VARIANCE

ＦＯＸＴＲＯＴ "0295E860

FIG.20

PAT253

①②③④⑤⑥⑦⑧⑨⑩⑪
B C D E F G H I J

00 1110 00
00 1100 00
00 1111 00

①②③

PAT254

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0111 00
00 0011 00
00 1111 00

PAT255

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1110 00
00 1100 00
00 1111 00

PAT256

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0111 00
00 0011 00
00 1111 00

PAT257

①②③④⑤⑥⑦⑧⑨⑩⑪
B C D E F G H I J

00 0000 00
00 0001 00
00 0011 00

①②③

PAT258

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 1000 00
00 1100 00

PAT259

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0001 00
00 0011 00

PAT260

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 1000 00
00 1100 00

FIG.21

PAT261

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 1100 00
00 1110 00
00 1111 00

PAT262

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0011 00
00 0111 00
00 1111 00

PAT263

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 1100 00
00 1110 00
00 1111 00

PAT264

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0011 00
00 0111 00
00 1111 00

B C D E F G H I J

① ② ③

FIG. 22A

(BLACK) 1

3/4

OUTPUT 1/2

α

(WHITE) 0   1/4 1/2   1 (BLACK)

INPUT

105-1

0 0 | 0 1 1 1 | 0 0

105-2

0 0 | 1 1 1 0 | 0 0

FIG. 22B

(BLACK) 1

OUTPUT 1/2

β

(WHITE) 0   1/2   1 (BLACK)

INPUT

106-1

0 0 | 0 0 1 1 | 0 0

106-2

0 0 | 1 1 0 0 | 0 0

FIG. 22C

(BLACK) 1

OUTPUT 1/2

1/4

γ

(WHITE) 0   1/2 3/4 1 (BLACK)

INPUT

108-1

0 0 | 0 0 0 1 | 0 0

108-2

0 0 | 1 0 0 0 | 0 0

特願平9－029268 (?)

FIG.23

PAT265

①②③④⑤⑥⑦⑧⑨⑩⑪
B
C
D
E
F
G
H
I
J

00 0001 00
00 0011 00
00 0111 00

①
②
③

PAT266

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1000 00
00 1100 00
00 1110 00

PAT267

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0001 00
00 0011 00
00 0111 00

PAT268

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1000 00
00 1100 00
00 1110 00

PAT269

①②③④⑤⑥⑦⑧⑨⑩⑪
B
C
D
E
F
G
H
I
J

00 1111 00
00 1110 00
00 0110 00

①
②
③

PAT270

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1111 00
00 0111 00
00 0110 00

PAT271

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1111 00
00 1110 00
00 0110 00

PAT272

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1111 00
00 0111 00
00 0110 00

FIG.24

PAT273

PAT274

PAT275

PAT276

PAT277

PAT278

PAT279

PAT280

00 0000 00
00 0001 00
00 0011 00

00 0000 00
00 1000 00
00 1100 00

00 0000 00
00 0001 00
00 0011 00

00 0000 00
00 1000 00
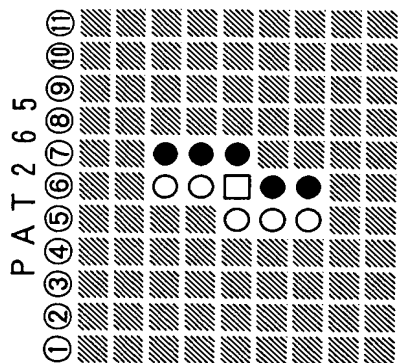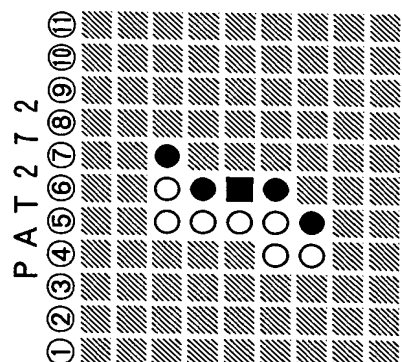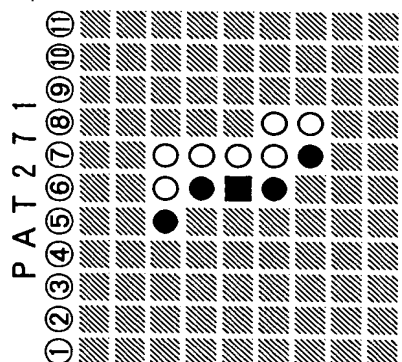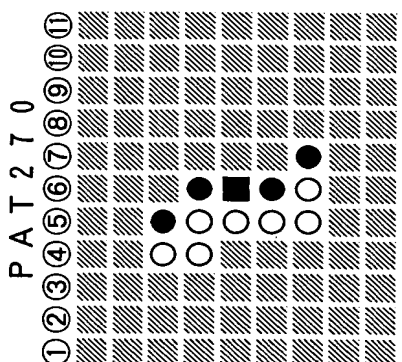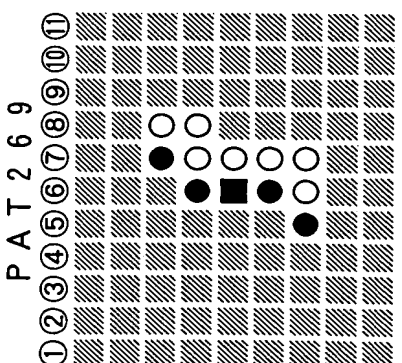00 1100 00

00 1100 00
00 1110 00
00 1111 00

00 0011 00
00 0111 00
00 1111 00

00 1100 00
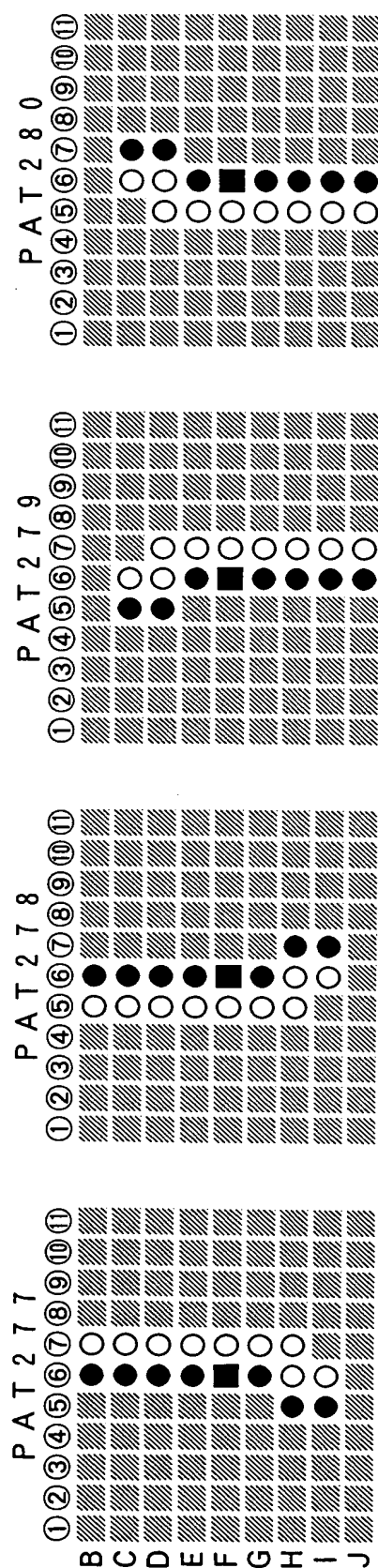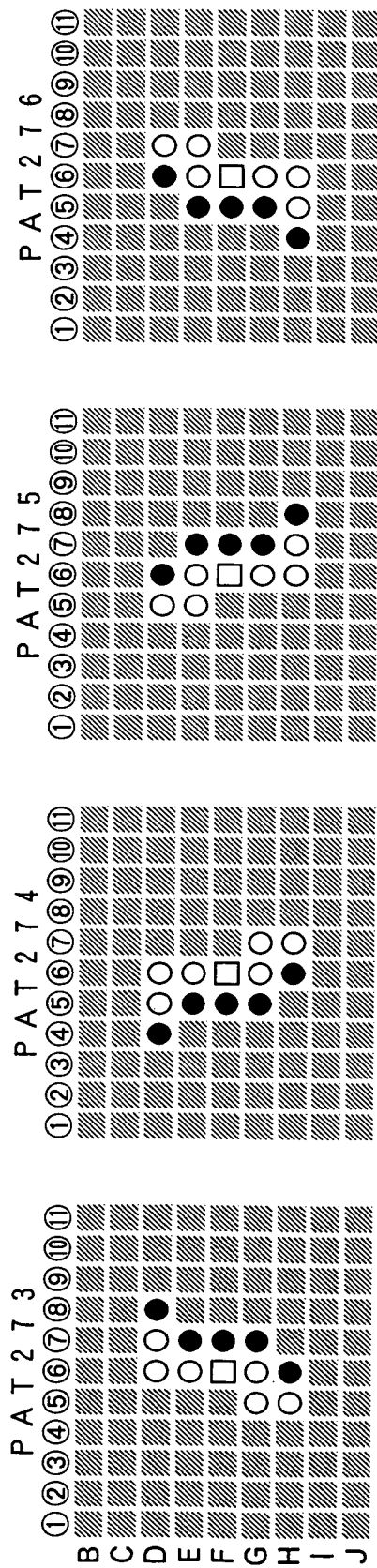00 1110 00
00 1111 00

00 0011 00
00 0111 00
00 1111 00

FIG.25

PAT281 PAT282 PAT283 PAT284

PAT285 PAT286 PAT287 PAT288

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪
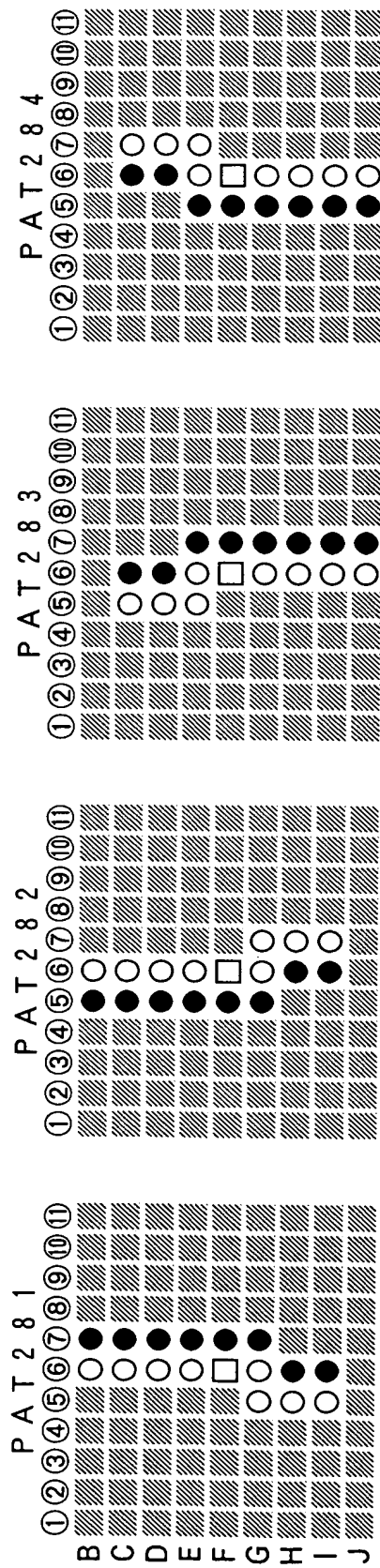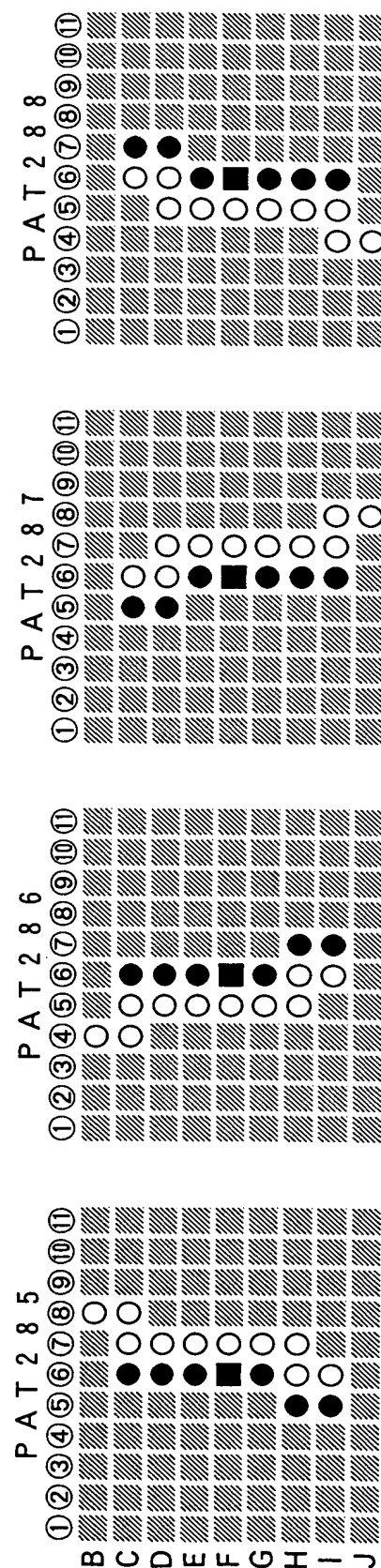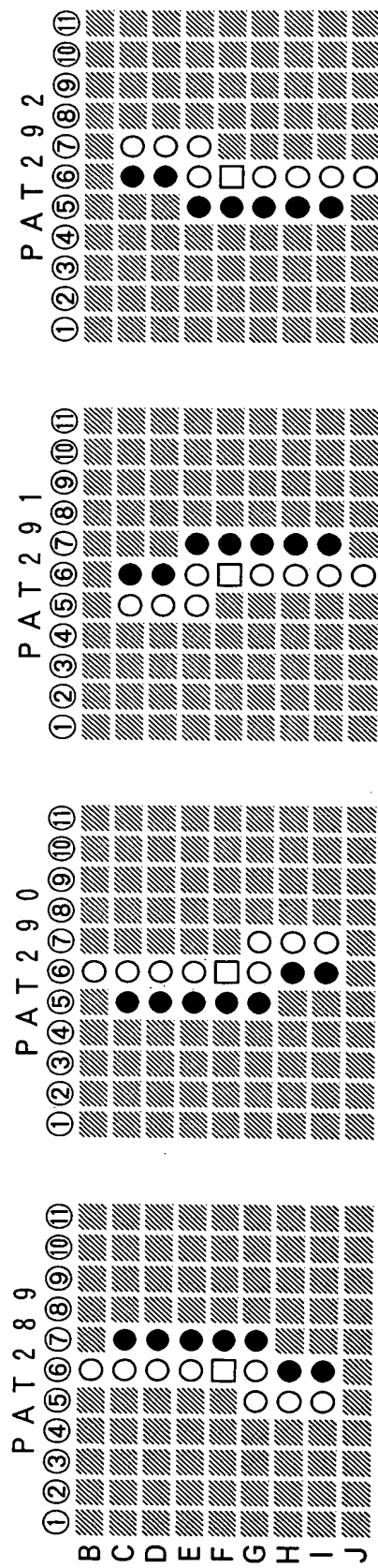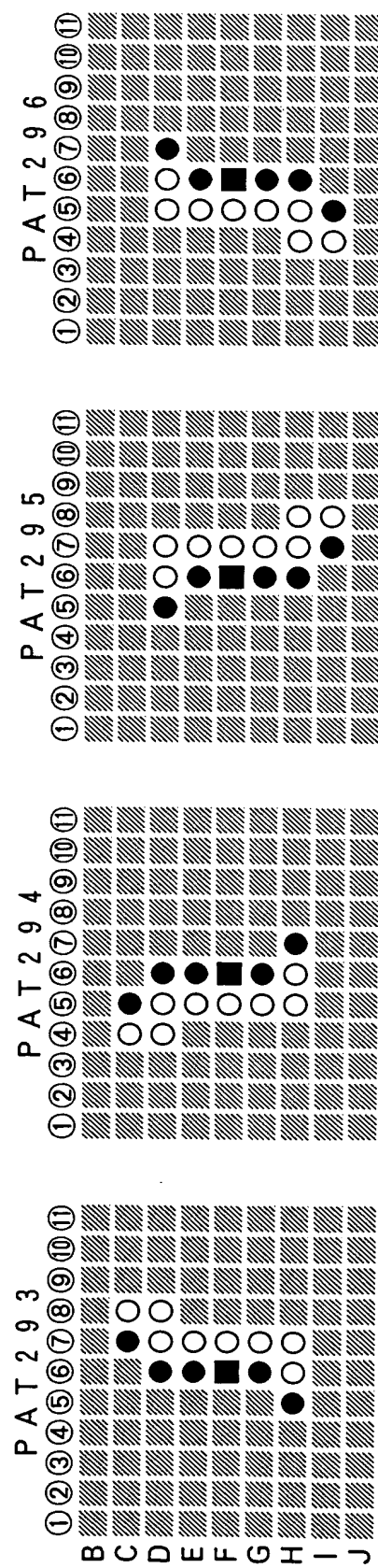
B C D E F G H I J

PAT281
00 0001 00
00 0011 00
00 0111 00

PAT282
00 1000 00
00 1100 00
00 1110 00

PAT283
00 0001 00
00 0011 00
00 0111 00

PAT284
00 1000 00
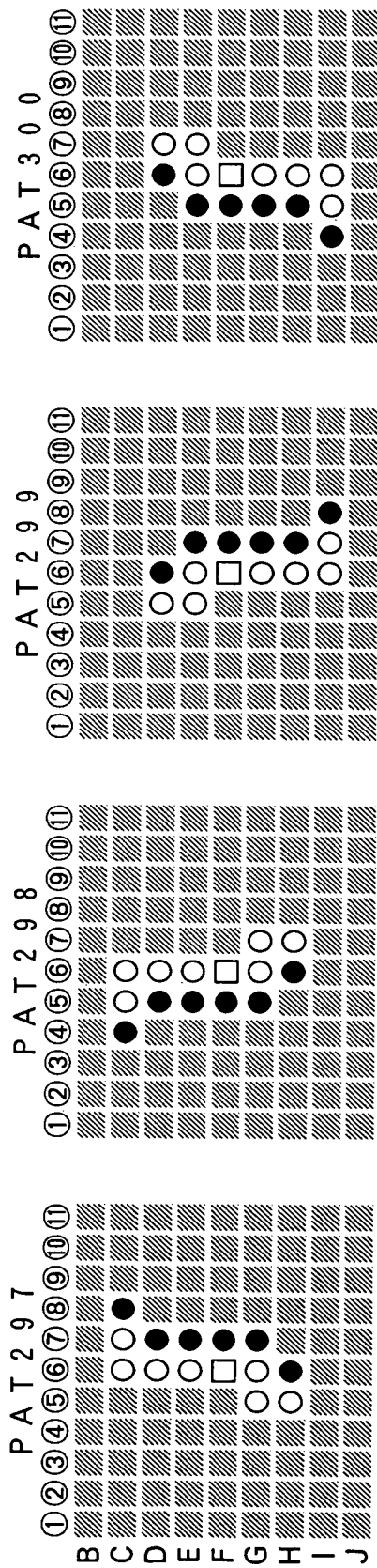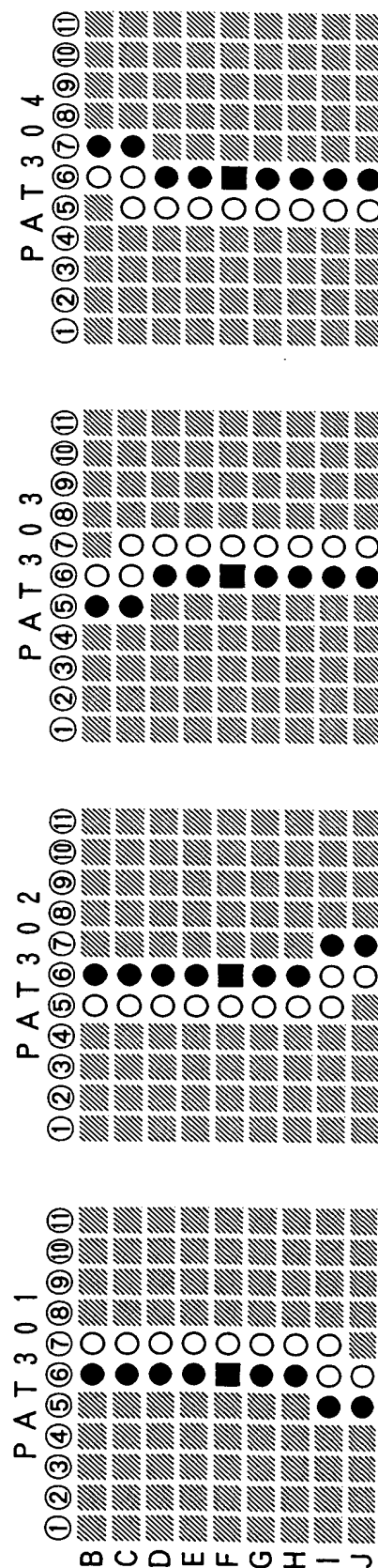00 1100 00
00 1110 00

PAT285
00 1100 00
00 1110 00
00 1111 00

PAT286
00 0011 00
00 0111 00
00 1111 00

PAT287
00 1100 00
00 1110 00
00 1111 00

PAT288
00 0011 00
00 0111 00
00 1111 00

① ② ③

FIG.26

FIG.27

FIG.28

PAT305

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D
E
F
G
H
I
J

00 0001 00
00 0011 00
00 0111 00

①
②
③

PAT306

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1000 00
00 1100 00
00 1110 00

PAT307

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0001 00
00 0011 00
00 0111 00

PAT308

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1000 00
00 1100 00
00 1110 00

PAT309

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D
E
F
G
H
I
J

00 1110 00
00 1100 00
00 1111 00

①
②
③

PAT310

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0111 00
00 0011 00
00 1111 00

PAT311

①②③④⑤⑥⑦⑧⑨⑩⑪

00 1110 00
00 1100 00
00 1111 00

PAT312

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0111 00
00 0011 00
00 1111 00

FIG.29

FIG. 30

PAT321

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪
B
C
D
E
F
G
H
I
J

① ② ③

00 0000 00
00 0001 00
00 0011 00

PAT322

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 0100 00
00 1100 00

PAT323

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 0001 00
00 0011 00

PAT324

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 0100 00
00 1100 00

FIG. 31

FIG.32

PAT79

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪
B
C
D
E
F
G
H
I
J

① 00 0000 00
② 00 0001 00
③ 00 0011 00

PAT80

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 1000 00
00 1100 00

PAT81

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 0001 00
00 0011 00

PAT82

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 1000 00
00 1100 00

PAT83

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪
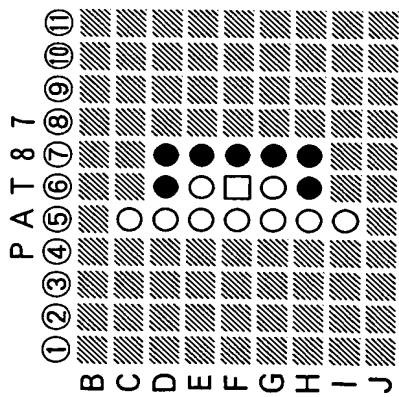B
C
D
E
F
G
H
I
J

① 00 0000 00
② 00 1000 00
③ 00 1100 00

PAT84

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 0001 00
00 0011 00

PAT85

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 1000 00
00 1100 00

PAT86

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

00 0000 00
00 0001 00
00 0011 00

FIG.33

F I G. 3 4

PAT95

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D
E
F
G
H
I
J

00 0100 00
00 0110 00
00 1110 00

PAT96

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0010 00
00 0110 00
00 0111 00

PAT97

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0100 00
00 0110 00
00 1110 00

PAT98

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0010 00
00 0110 00
00 0111 00

PAT99

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D
E
F
G
H
I
J

00 0000 00
00 1000 00
00 1100 00

PAT100

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0001 00
00 0011 00

PAT101

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 1000 00
00 1100 00

PAT102

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0001 00
00 0011 00

①②③

FIG. 35

PAT103

PAT104

PAT105

PAT106

PAT107

PAT108

PAT109

PAT110

00 0000 00
00 0010 00
00 0110 00

00 0000 00
00 0100 00
00 0110 00

00 0000 00
00 0010 00
00 0110 00

00 0000 00
00 0100 00
00 0110 00
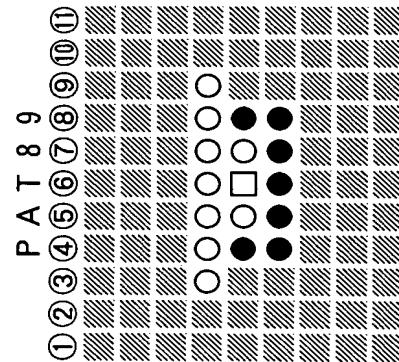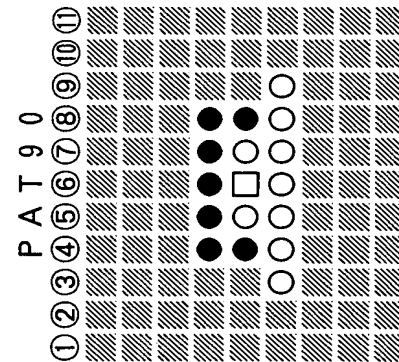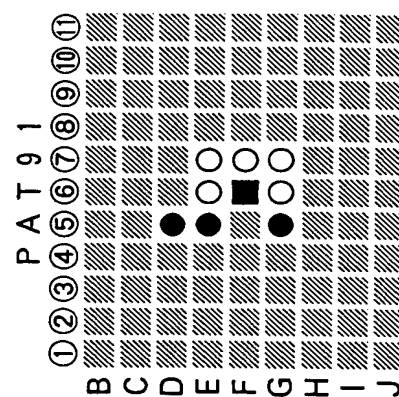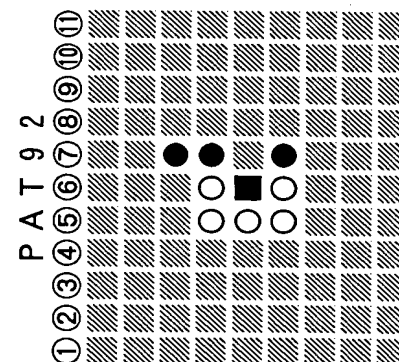
00 0000 00
00 0001 00
00 0011 00

00 0000 00
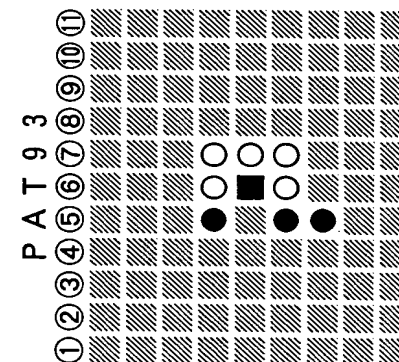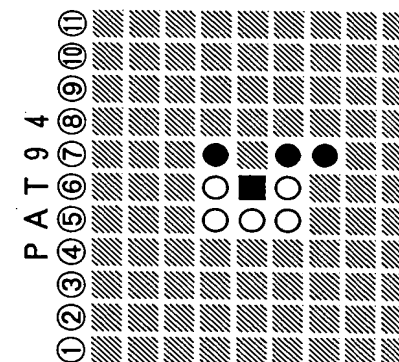00 1000 00
00 1100 00

00 0000 00
00 0001 00
00 0011 00

00 0000 00
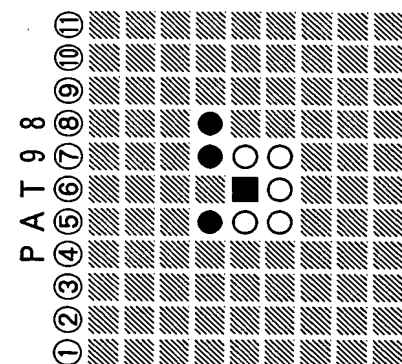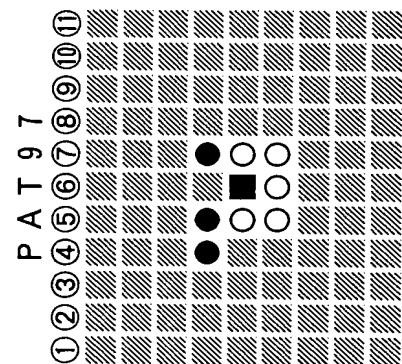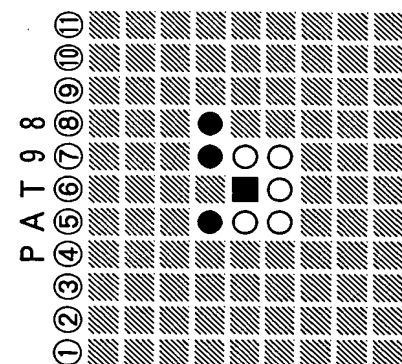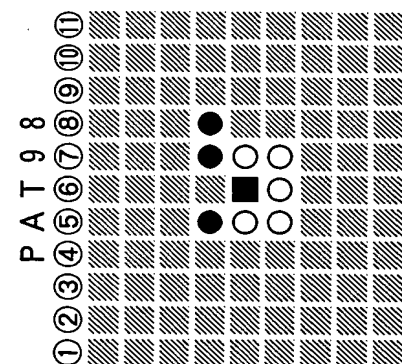00 1000 00
00 1100 00

FIG.36

PAT111

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D
E
F
G
H
I
J

00 0000 00
00 0010 00
00 0110 00

①
②
③

PAT112

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT113

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT114

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

FO/tho" 0295E860

FIG.37

PAT139

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT140

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT141

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT142

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT143

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0100 00
00 0110 00
00 1110 00

PAT144

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0010 00
00 0110 00
00 0111 00

PAT145

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0100 00
00 0110 00
00 1110 00

PAT146

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0010 00
00 0110 00
00 0111 00

B C D E F G H I J

① ② ③

FIG.38

PAT147

PAT148

PAT149

PAT150

B
C
D
E
F
G
H
I
J

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① ② ③
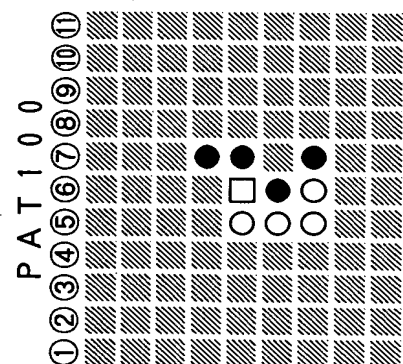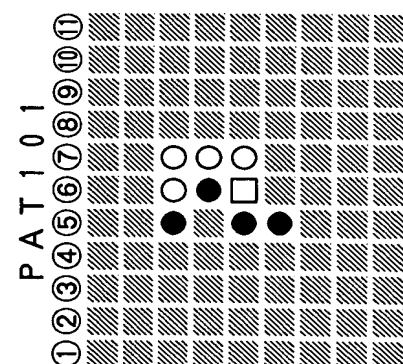
00 0000 00
00 1000 00
00 1100 00

00 0000 00
00 0001 00
00 0011 00

00 0000 00
00 1000 00
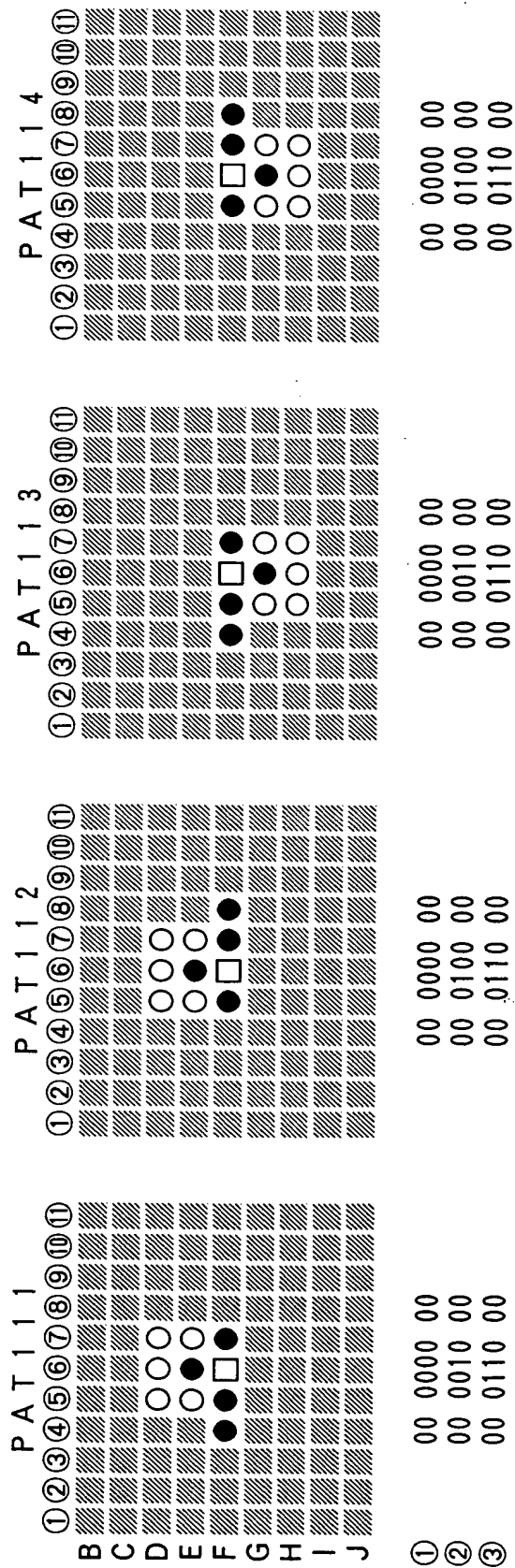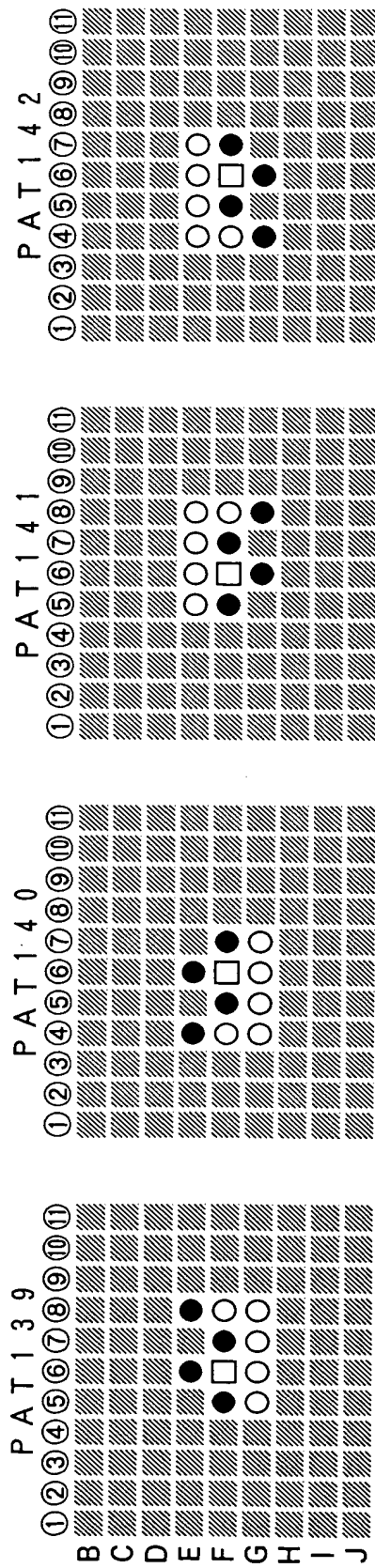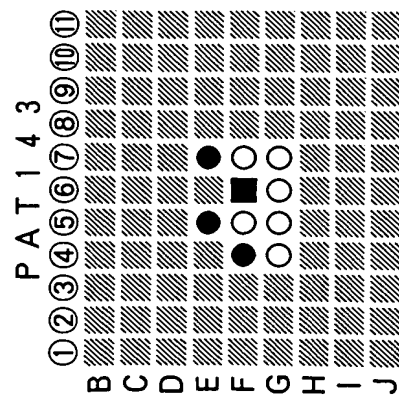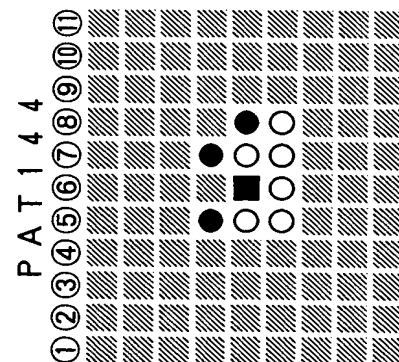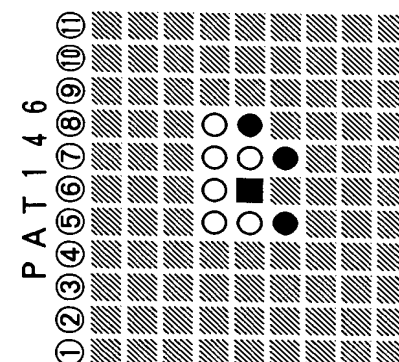00 1100 00

00 0000 00
00 0001 00
00 0011 00

FIG. 39A

PAT100

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D
E .... ● .... —150
F .... ○ □ ● ....
G .... ○ ● .... —152
H .... ○ ○ ● ....
I .... —154
J

①   00   0000   00
②   00   [0001]   00   —156
③   00   0011   00

FIG. 39B

PAT92

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D .... ● .... —150
E .... ○ ○ ● ....
F .... ○ ■ .... —152
G .... ○ ○ ● ....
H .... —154
I
J

①   00   0001   00
②   00   [0011]   00   —158
③   00   0111   00

FIG. 39C

PAT102

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D .... ○ ○ ● .... —150
E .... ○ ● .... —152
F .... ○ □ ● ....
G .... ● .... —154
H
I
J

①   00   0000   00
②   00   [0001]   00   —160
③   00   0011   00

F I G. 4 0

DENSITY-PRESERVATION-PATTERN COMBINATIONS		
PAT91	PAT99	PAT101
PAT92	PAT100	PAT102
PAT93	PAT101	PAT99
PAT94	PAT102	PAT100

FIG. 41A

PAT 1 5 1

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① 　　　 00 0100 00
② 　　　 00 0110 00
③ 　　　 00 0111 00

FIG. 41B

PAT 1 5 2

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① 　　　 00 0011 00
② 　　　 00 0111 00
③ 　　　 00 1111 00

FIG. 41C

PAT 1 5 3

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① 　　　 00 1100 00
② 　　　 00 1110 00
③ 　　　 00 1111 00

FIG. 42A

110 3×3 MATRIX

112

114

114

FIG. 42B

118 4×4 MATRIX

120

122

124 · 126

FIG. 42C

128 5×5 MATRIX

140

130

132

134 136 138

FIG. 43

EP 0 959 240 A1

FIG. 44

PAT7

B
C
D
E
F
G
H
I
J

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT8

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT9

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT10

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT11

B
C
D
E
F
G
H
I
J

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT12

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT13

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT14

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

①②③

F I G . 4 5

PAT15

PAT16

PAT17

PAT18

PAT19

PAT20

PAT21

PAT22

00 0000 00
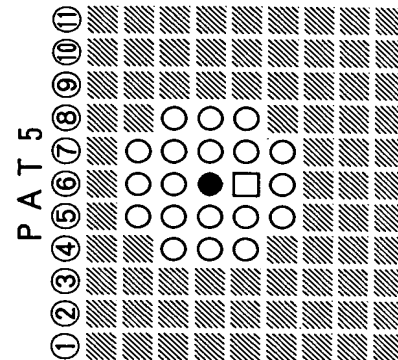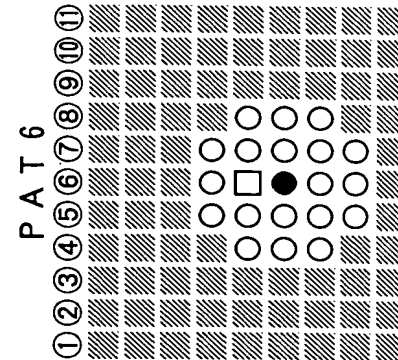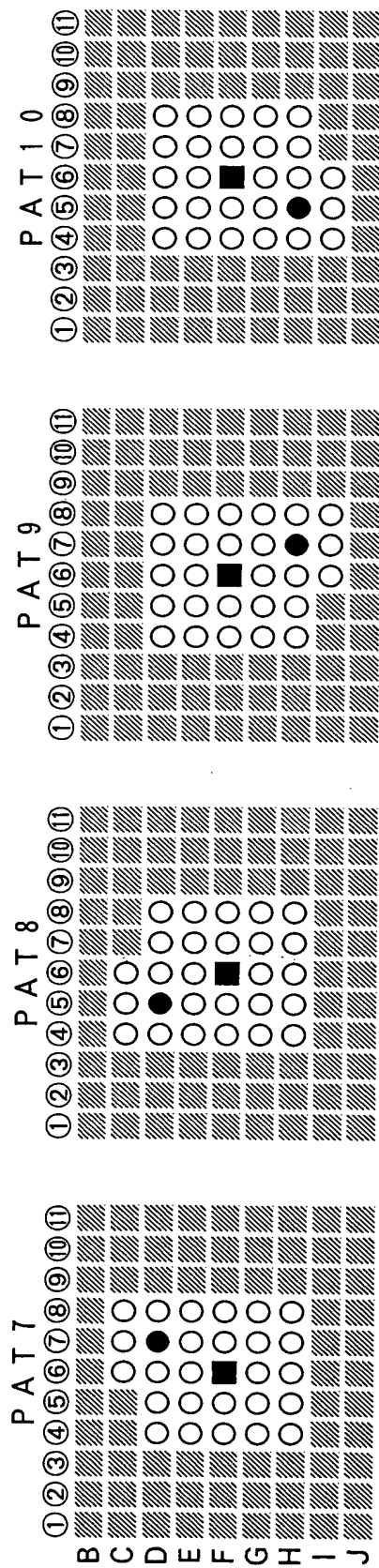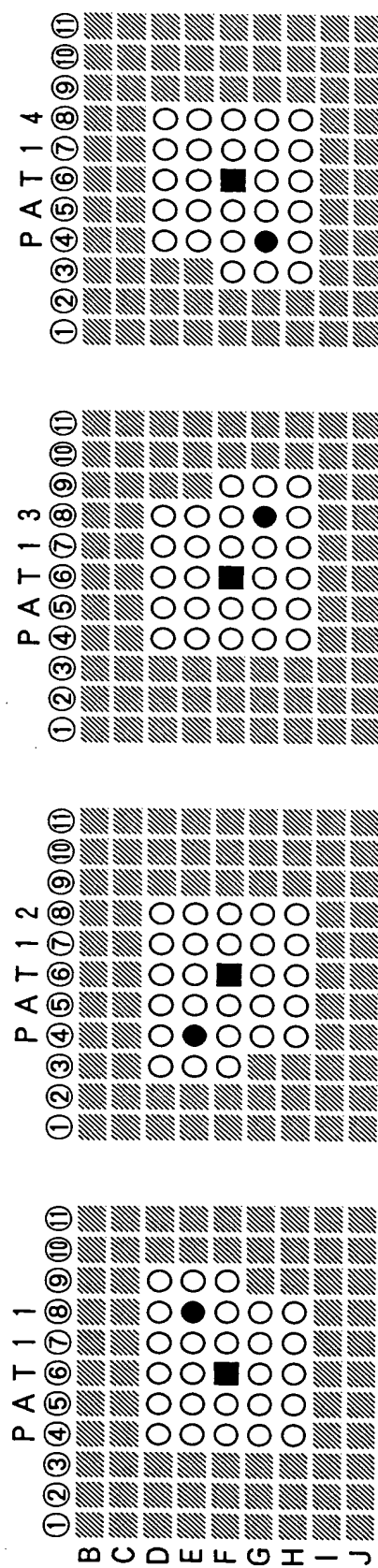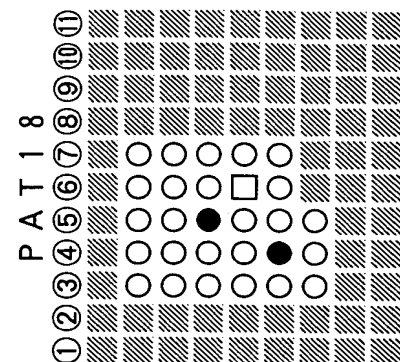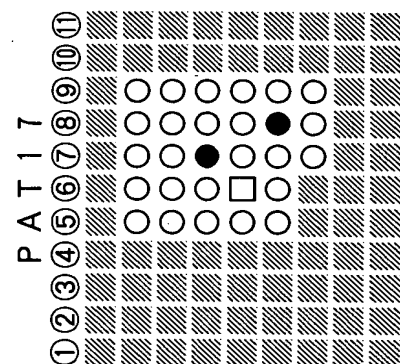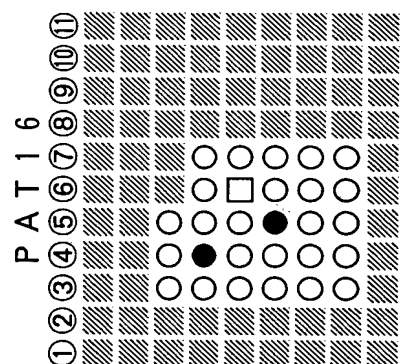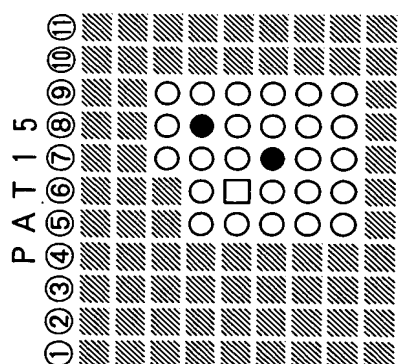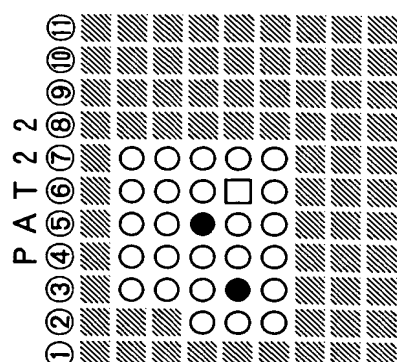00 0100 00
00 0110 00

00 0000 00
00 0010 00
00 0110 00

00 0000 00
00 0100 00
00 0110 00

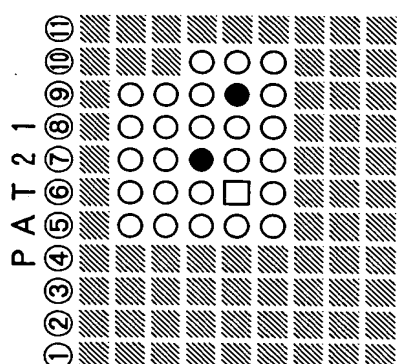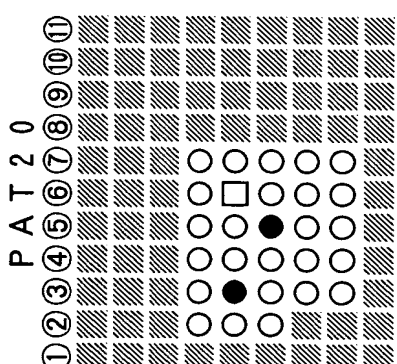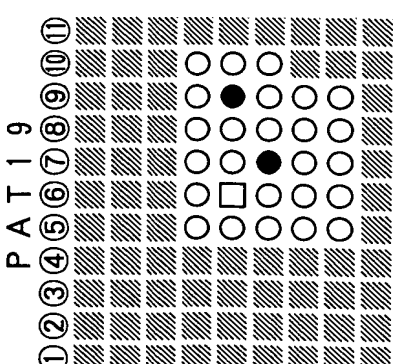00 0000 00
00 0010 00
00 0110 00

①②③④⑤⑥⑦⑧⑨⑩⑪

B
C
D
E
F
G
H
I
J

①
②
③

FIG.46

PAT23

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
B
C   ○●○○○○○○
D   ○○○●○○○
E   ○○○□○○
F   ○○○○○○
G
H
I
J
```

```
00 0000 00
00 0100 00
00 0010 00
```

PAT24

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
    ○○○○○○○
    ○●○○○○
    ○○○●○○
    ○○□○
    ○○○○○○
```

```
00 0000 00
00 0010 00
00 0110 00
```

PAT25

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
    ○○○○○
    ○□○○○
    ○○●○○○
    ○○○○○●○
    ○○○○○
```

```
00 0000 00
00 0100 00
00 0110 00
```

PAT26

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
    ○○○○○
    ○□○○○
    ○○●○○○
    ○○○○●○
    ○○○○○
```

```
00 0000 00
00 0010 00
00 0110 00
```

PAT27

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
B
C   ○○○○○
D   ○●○○○○
E   ○○○○○
F   ○○●○○○
G   ○○○□○○
H
I
J
```

```
00 0000 00
00 0100 00
00 0110 00
```

PAT28

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
    ○○○○○
    ○○○□○
    ○○●○○
    ○●○○○○
    ○○○○○
```

```
00 0000 00
00 0010 00
00 0110 00
```

PAT29

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
    ○○○●○
    ○○○○○○
    ○○●○○○
    ○□○○○
    ○○○○○○
```

```
00 0000 00
00 0100 00
00 0110 00
```

PAT30

```
    ①②③④⑤⑥⑦⑧⑨⑩⑪
    ○○○○○
    ○□○○○
    ○○●○○○
    ○○○●○
    ○○○○○○
```

```
00 0000 00
00 0010 00
00 0110 00
```

```
①
②
③
```

TO／tho″0295E860

FIG.47

PAT31

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT32

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT33

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT34

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0010 00

PAT35

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT36

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

PAT37

①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0010 00
00 0110 00

PAT38
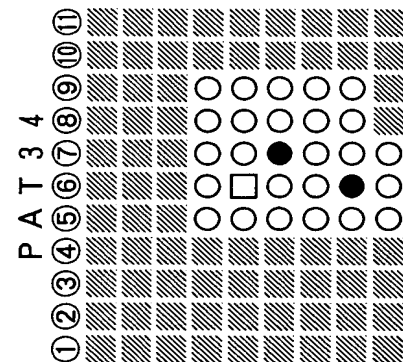
①②③④⑤⑥⑦⑧⑨⑩⑪

00 0000 00
00 0100 00
00 0110 00

B C D E F G H I J

①②③

FIG.48

PAT39 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0100 00
00 0110 00
00 1110 00

PAT40 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0010 00
00 0110 00
00 0111 00

PAT41 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0100 00
00 0110 00
00 1110 00

PAT42 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0010 00
00 0110 00
00 0111 00

PAT43 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0100 00
00 0110 00
00 1110 00

PAT44 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0010 00
00 0110 00
00 0111 00

PAT45 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0100 00
00 0110 00
00 1110 00

PAT46 ①②③④⑤⑥⑦⑧⑨⑩⑪
00 0010 00
00 0110 00
00 0111 00

B C D E F G H I J
① ② ③

F I G. 4 9

FIG.50

FIG. 51

F I G. 5 2

FIG. 53

F I G. 5 4

142-1   142-2

F I G. 5 5

144-1   144-2

F I G. 5 6

146-1

146-2

0965650"040/701

FIG.57

F I G.58A

```
         START
           │
S1 ─  INPUT BINARY IMAGE DATA
           │
S2 ─  CUT OFF JUDGMENT MATRIX
           │
S3 ─  PERFORM COMPARISON
      TO FIRST IRREGULARITY
      DETECTION PATTERN
           │
S4 ─  PATTERNS MATCHED?
        │NO      │YES ──────────┐
        │                       │
S5 ─  INTERRUPTION              │
      FLAG                      │
      TURNED ON?        S9 ─ TURN ON INTERRUPTION FLAG
        │NO    │YES             FOR SMOOTHING PROCESSING
                                WITH SECOND IRREGULARITY
                                DETECTION PATTERN
```

FIG.58B

PERFORM COMPARISON
TO SECOND IRREGULARITY
DETECTION PATTERN — S6

PATTERNS MATCHED ? — S7

NO

YES

CORRECT ATTENTION DOT
AND PERFORM SMOOTHING
PROCESSING FOR
IRREGULARITY — S8

CORRECT ATTENTION DOT
AND PERFORM SMOOTHING
PROCESSING FOR
IRREGULARITY — S10

OUTPUT PROCESSING DOT — S11

ALL DOTS PROCESSED ? — S12

NO

YES

END

F I G. 5 9

80 FIRST IMAGE-QUALITY CORRECTOR UNIT

76 BINARY-DATA STORAGE UNIT

78 MATRIX CUT-OUT UNIT

88 FIRST COMPARATOR UNIT (SLANTING-LINE IRREGULARITY DETECTION)

90 FIRST IRREGULAR-PATTERN STORAGE UNIT

92 FIRST CORRECTOR UNIT

86 DOT OUTPUT UNIT

100 THIRD COMPARATOR UNIT (ISOLATED-DOT DETECTION)

102 ISOLATED-DOT-PATTERN STORAGE UNIT

104 THIRD CORRECTOR UNIT

84 THIRD IMAGE-QUALITY CORRECTOR UNIT

75 CONTROLLER UNIT

FIG.60A

START

S1 — INPUT BINARY IMAGE DATA

S2 — CUT OFF JUDGMENT MATRIX

S3 — PERFORM COMPARISON TO FIRST IRREGULARITY DETECTION PATTERN

S4 — PATTERNS MATCHED?

NO

YES

S5 — INTERRUPTION FLAG TURNED ON?

NO

YES

S9 — TURN ON INTERRUPTION FLAG FOR SMOOTHING PROCESSING WITH ISOLATED-DOT PATTERN

FIG.60B

S6 — PERFORM COMPARISON TO ISOLATED-DOT-DETECTION PATTERN

S7 — PATTERNS MATCHED ?

NO

YES

S8 — PERFROM VARIANCE-CORRECTION OF ISOLATED DOT

S10 — CORRECT ATTENTION DOT AND PERFORM SMOOTHING PROCESSING FOR IRREGULARITY

S11 — OUTPUT PROCESSING DOT

S12 — ALL DOTS PROCESSED ?

NO

YES

END

F I G. 6 1

FIG. 62

110 SCALE-VARYING
PROCESSOR UNIT

114

MAGNIFICATION PROCESSOR UNIT	REDUCTION PROCESSOR UNIT

116

ORIGINAL IMAGE 118

Q

P

MAGNIFIED IMAGE 120

N

M

REDUCED IMAGE 122

n

m

112 IMAGE STORAGE UNIT

F I G. 6 3

```
        ( SCALE-VARYING PROCESSING )
                     │
                     ↓
  S1~  ┌─────────────────────────────────────┐
       │        READ ORIGINAL IMAGE          │
       └─────────────────────────────────────┘
                     │
                     ↓
  S2~  ┌─────────────────────────────────────┐
       │       PERFORM MAGNIFICATION         │
       │  PROCESSING BY INTERPOLATION        │
       └─────────────────────────────────────┘
                     │
                     ↓
  S3~  ┌─────────────────────────────────────┐
       │  PERFORM REDUCTION PROCESSING       │
       │      BY REMOVAL OPERATION           │
       └─────────────────────────────────────┘
                     │
                     ↓
                 ( END )
```

FIG.64A 118

A	B	C
D	E	F
G	H	I

FIG.64B 120

A	(A+B)/2	B	(B+C)/2	C
(A+B)/2	(A+B+C+D)/4	(B+C)/2	(C+D+E+F)/4	(C+F)/2
D	(D+E)/2	E	(E+F)/2	F
(D+G)/2	(D+E+G+H)/4	(E+H)/2	(E+F+H+I)/4	(F+I)/2
G	(G+H)/2	H	(H+I)/2	I

F I G. 6 5A

```
┌─────────────────────────────────┐
│          REDUCTION              │
│   PROCESSING BY REMOVAL         │
│          OPERATION              │
└─────────────────────────────────┘
                 │
                 ▼
S1 ┌─────────────────────────────────┐
   │      READ MAGNIFIED  IMAGE      │
   └─────────────────────────────────┘
                 │
                 ▼
S2 ┌─────────────────────────────────┐
   │  BASED ON REDUCTION RATIO K2,   │
   │ CALCULATE REMOVAL-LINE NUMBER HN│
   │  IN PRIMARY-SCAN DIRECTION AND  │
   │   REMOVAL-LINE NUMBER VN IN     │
   │   SECONDARY-SCAN DIRECTION      │
   │   HN = PRIMARY-SCAN-DIRECTION   │
   │        LINE NUMBER × (1−K)      │
   │   VN = SECONDARY-SCAN-DIRECTION │
   │        LINE NUMBER × (1−K)      │
   └─────────────────────────────────┘
                 │
                 ▼
S3 ┌─────────────────────────────────┐
   │  SPECIFY REMOVAL IN Y LINE UNITS│
   │   IN PRIMARY SCAN DIRECTION AND │
   │       IN X LINE UNITS           │
   │   Y = TOTAL LINE NUMBER/HN      │
   │   X = TOTAL LINE NUMBER/VN      │
   └─────────────────────────────────┘
                 │
                 ▼
S4 ┌─────────────────────────────────┐
   │  SELECT ONE LINE IN PRIMARY OR  │
   │  SECONDARY SCAN DIRECTION       │
   └─────────────────────────────────┘
                 │
                 ▼
S5 ┌─────────────────────────────────┐
   │  SELECT CANDIDATE REMOVAL PIXELS│
   └─────────────────────────────────┘
                 │
                 ▼
```

F I G. 6 5 B

CALCULATE GRADIENT VARIATION
AMOUNT D BY SPECIFYING 64×64
MATRIX WITH CANDIDATE PIXELS
AS ATTENTION PIXELS

$$D = \sum_{i=1}^{64} |PERIPHERAL \ PIXELS - ATTENTION \ PIXELS|$$

S6

S11

SELECT
ADJACENT PIXELS

GRADIENT
VARIATION AMOUNT GREATER
(D≧TH) ?

S7

YES

NO
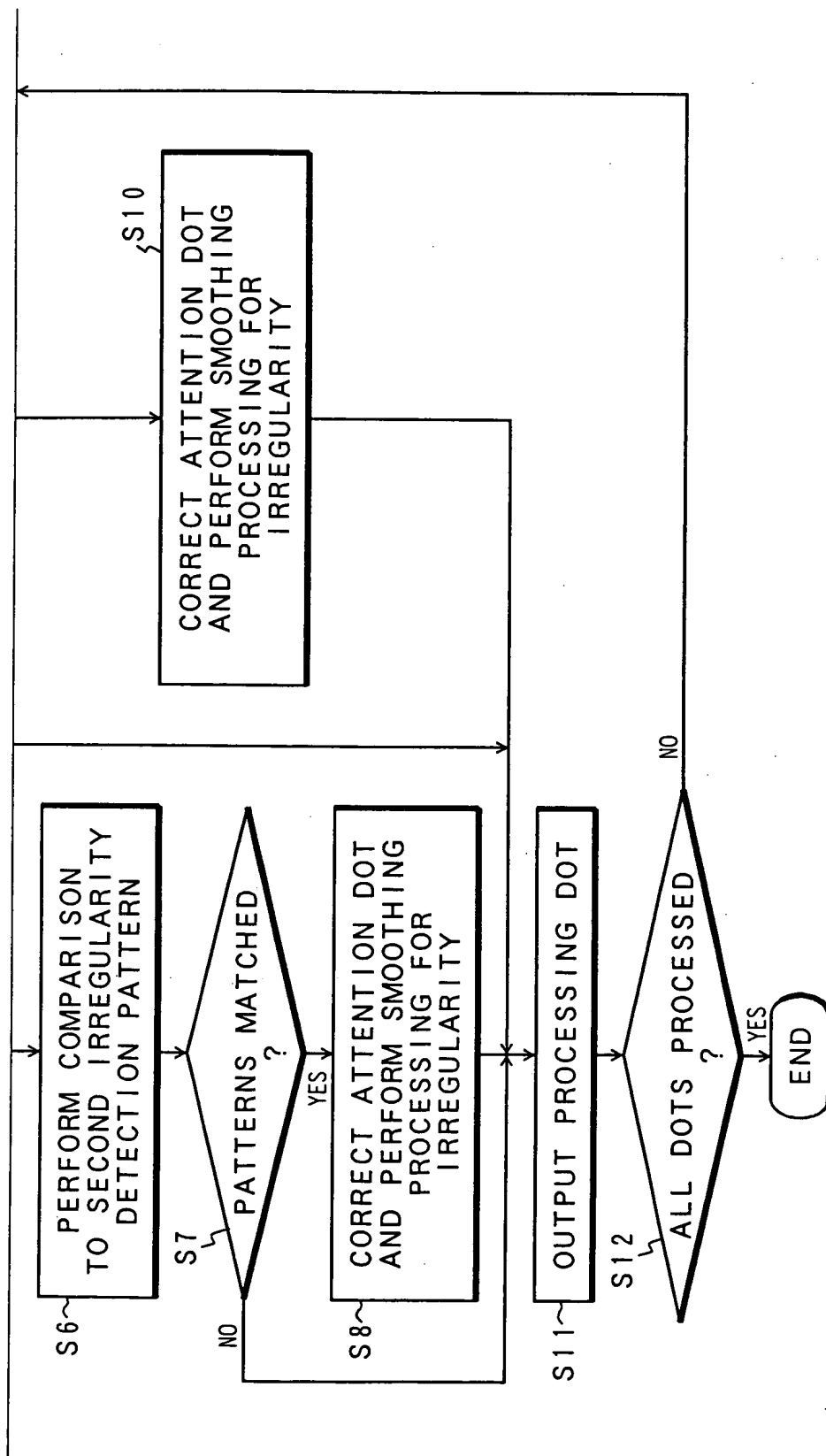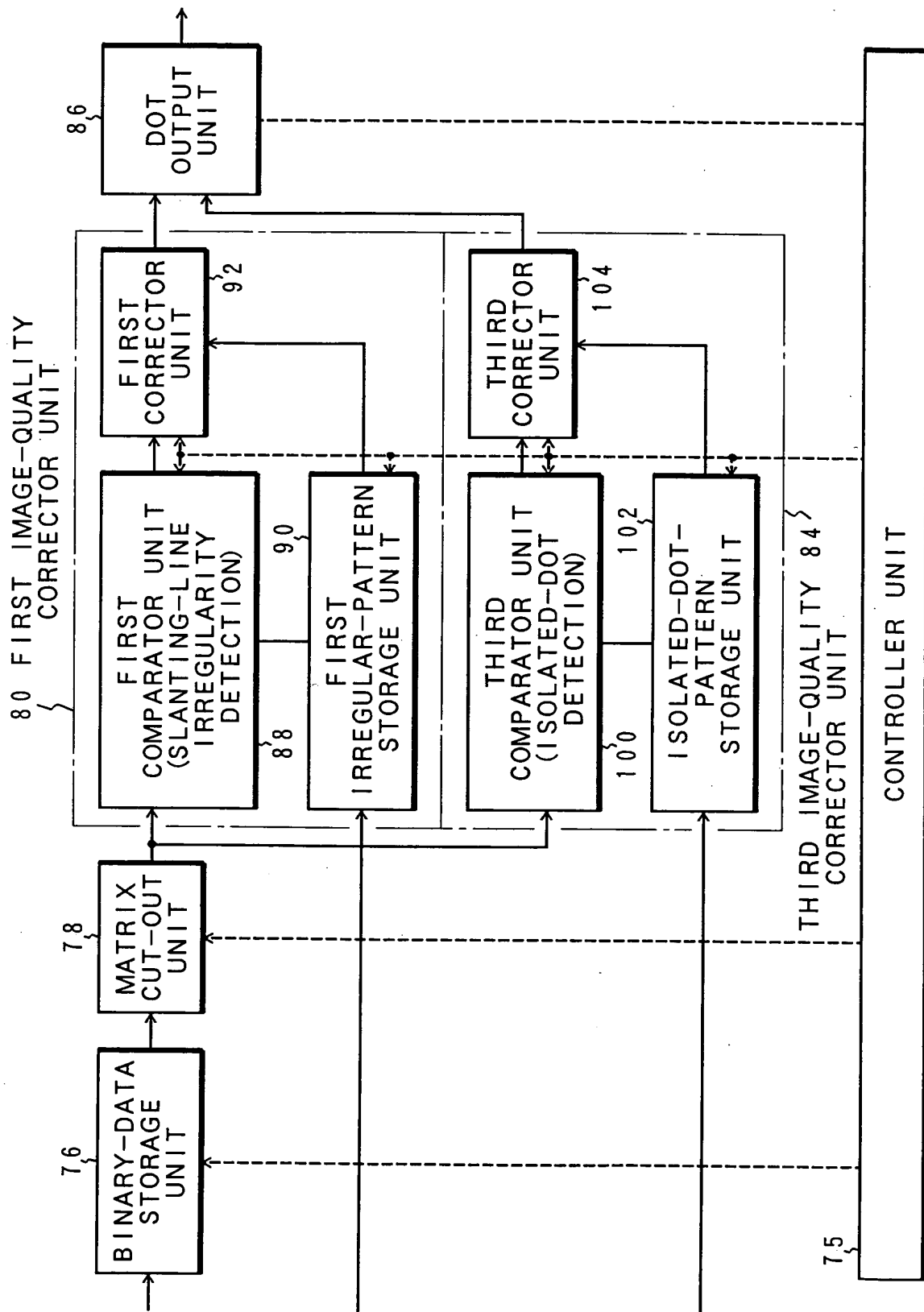
REMOVE ATTENTION PIXELS

S8

ONE LINE REMOVED?

S9

NO

YES

ALL LINES REMOVED?

S10

NO

YES

END

FIG. 66

FIG. 67A

FIG. 67B

FIG. 67C